September 1992

Idaho
National
Engineering
Laboratory

IDAHO DEPARTMENT
OF HEALTH AND WELFARE

DIVISION OF
ENVIRONMENTAL QUALITY

Record of Decision

Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23)

Operable Unit 1-07A
Waste Area Group 1
Idaho National Engineering Laboratory
Idaho Falls, Idaho

DECLARATION OF THE RECORD OF DECISION

Site Name and Location

TSF Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23)
Operable Unit (OU) 1-07A
Waste Area Group 1
Idaho National Engineering Laboratory
Idaho Falls, Idaho

Statement of Basis and Purpose

This decision document presents the selected interim remedial action for the Technical Support Facility (TSF) Injection Well (TSF-05), and the groundwater surrounding the injection well (TSF-23) as described in the Federal Facility Agreement/Consent Order (FFA/CO). This action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the site.

The State of Idaho Department of Health and Welfare (IDHW) concurs with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

This interim action is intended to prevent further degradation of the groundwater by reducing contaminants near the TSF-05 injection well and in the surrounding groundwater. The selected remedy will also not be inconsistent with nor preclude the implementation of the final response action scheduled to be determined in 1994.

The major components of the selected remedy include:

- Extract contaminated groundwater from the TSF-05 injection well and perhaps nearby groundwater monitoring wells that are capable of capturing contaminated groundwater.
- Install two groundwater monitoring wells within the contaminant plume to monitor the effectiveness of the interim action. These wells may also be used as extraction wells to expedite the removal of contaminated groundwater.
- Install on-site groundwater treatment facilities to reduce contaminants of concern in the extracted groundwater to prescribed performance standards. The selected treatment system is air stripping, carbon adsorption, and ion exchange.

- Monitor the groundwater contaminant plume and the extraction/treatment system during groundwater extraction activities to track the effectiveness of the system and to ensure that performance standards are achieved.

- Modify the existing Test Area North (TAN) disposal pond to receive the treated groundwater and ensure that discharge water quality does not further degrade the underlying Snake River Plain Aquifer above maximum contaminant levels.

- Implement administrative and institutional controls that supplement engineering controls and minimize exposure to releases of hazardous substances during remediation.

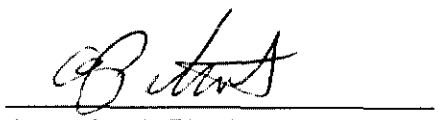
Statutory Determinations

This interim action is protective of human health and the environment, complies with Federal and State applicable or relevant and appropriate requirements for this limited-scope action, and is cost-effective. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action utilizes treatment and thus is in furtherance of that statutory mandate.

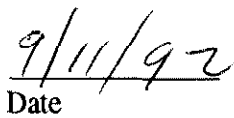
Although this is an interim action, it is intended to prevent further degradation of the groundwater until the final remedy for OU 1-07 is selected. Because this action does not constitute the final remedy for OU 1-07, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent investigations are planned to address the potential threats posed by the conditions at OU 1-07.

Because this remedy will result in hazardous substances remaining on site above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within two years after commencement of the remedial action. Because this is an interim action ROD, review of these sites and of this remedy will be continuing while developing final remedial alternatives for OU 1-07.

Signature sheet for the foregoing Operable Unit 1-07A TSF-05 injection well and surrounding groundwater interim action at the Test Area North at the Idaho National Engineering Laboratory Record of Decision between the United States Department of Energy and the United States Environmental Protection Agency, with concurrence by the Idaho Department of Health and Welfare.



Augustine A. Pitrolo
Manager
Department of Energy, Idaho Field Office



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Dana A Rasmussen SEP 28 1992

Dana Rasmussen
Regional Administrator, Region 10
Environmental Protection Agency

Date

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Richard Donovan
Director
Idaho Department of Health and Welfare

Sept 28, 1992
Date

CONTENTS

TABLES

FIGURES

ACRONYMS

ANP	Aircraft Nuclear Program
ARARs	applicable or relevant and appropriate requirements
BDAT	Best Demonstrated Available Technology
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
Ci	Curies
CLP	Contract Laboratory Program
COCA	Consent Order and Compliance Agreement
CRP	Community Relations Plan
DOE	Department of Energy
EPA	Environmental Protection Agency
FET	Flight Engine Test facility
FFA/CO	Federal Facility Agreement/Consent Order
FR	Federal Register
gpd	gallons per day
gpm	gallons per minute
HI	Hazard Index
ICPP	Idaho Chemical Processing Plant
IDAPA	Idaho Administrative Procedures Act
IDHW	State of Idaho Department of Health and Welfare
IET	Initial Engine Test Facility
INEL	Idaho National Engineering Laboratory
lb/hr	pounds per hour
LOFT	Loss-of-Fluid Test Facility
MCL	maximum contaminant level
mrem/yr	millirem per year
NA	not applicable
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	non-detect
NPL	National Priorities List
OU	Operable Unit
PCE	tetrachloroethylene
pCi/L	picocuries per liter
PPE	personal protective equipment
PWTU	Portable Water Treatment Unit
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
SARA	Superfund Amendments and Reauthorization Act
TAN	Test Area North
TCE	Trichloroethylene
TCLP	Toxicity Characteristic Leachate Procedure
TSF	Technical Support Facility

- USGS — United States Geological Survey
- VOC — Volatile Organic Compound
- WAG — Waste Area Group
- WERF — Waste Experimental Reduction Facility
- WRRTF — Water Reactor Research Test Facility
- µg/gm — micrograms per gram
- µg/L — micrograms per liter
- $\mu g/m^3$ — micrograms per cubic meter

DECISION SUMMARY

Introduction

The Idaho National Engineering Laboratory (INEL) was proposed for listing on the National Priorities List (NPL) on July 14, 1989 (54 Federal Register [FR] 29820). The listing was proposed by the United States Environmental Protection Agency (EPA) under the authorities granted EPA by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The final rule that listed the INEL on the NPL was published on November 21, 1989, in 54 FR 44184.

1. SITE NAME, LOCATION AND DESCRIPTION

The INEL is an 890-square mile Federal facility operated by the United States Department of Energy (DOE) (Figure 1-1). The primary missions of the INEL are nuclear reactor technology development and waste management.

Current land use at the INEL is classified as industrial and mixed use by the United States Bureau of Land Management and the INEL has been designated as a National Environmental Research Park. The developed area within the INEL is surrounded by a 500 square mile buffer zone used for cattle and sheep grazing. All livestock are kept approximately 12 miles away from the Test Area North (TAN) complex. However, wild species such as antelope, are allowed to roam freely within and across the INEL boundaries. These wild species are prevented from entering operational areas at the INEL by security fences.

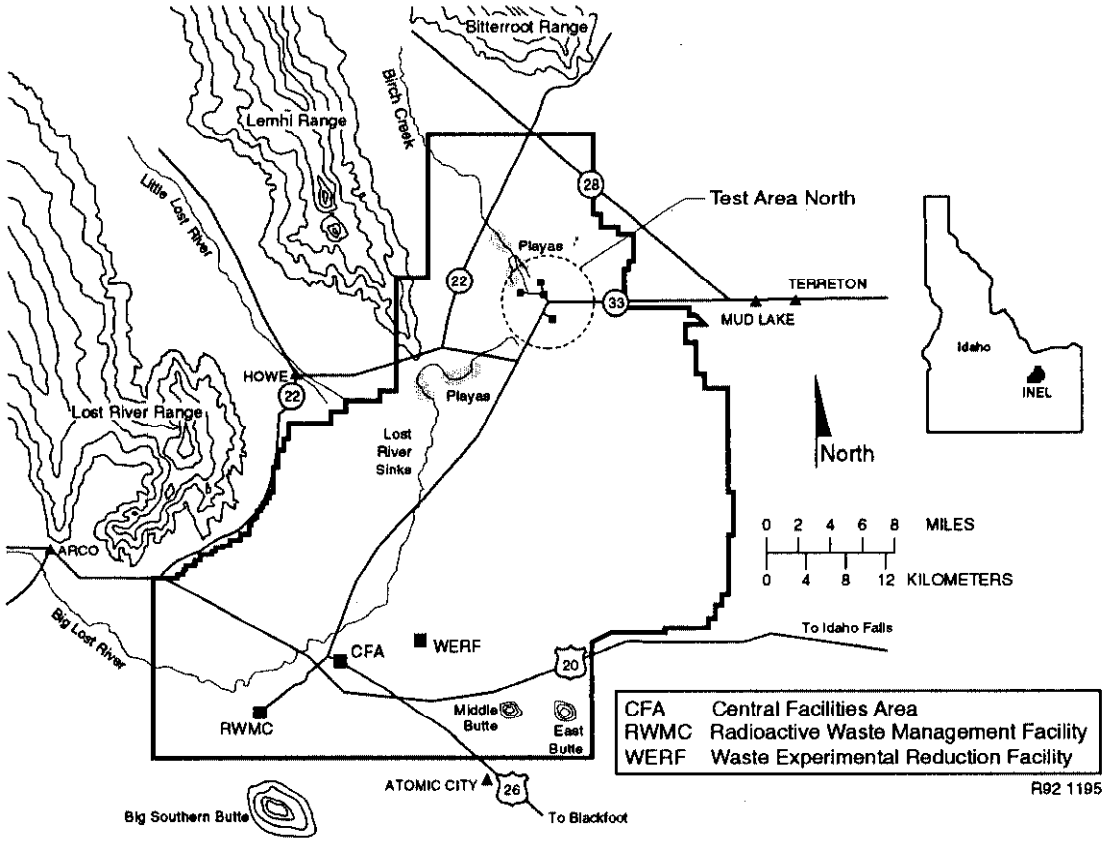

Figure 1-1. Test Area North at the Idaho National Engineering Laboratory.

Approximately 7,700 people are employed at the INEL, with an estimated 650 employed at the TAN. The nearest off-site populations are in the cities of: Terreton and Mud Lake (12 miles east); Arco (22 miles west); Blackfoot (38 miles southeast); Idaho Falls (49 miles east); and Pocatello (67 miles southeast).

The INEL has semidesert characteristics with hot summers and cold winters. Normal annual precipitation is 9.1 inches per year, with estimated evapotranspiration rates of 6 to 9 inches per year. Twenty distinctive vegetation cover types have been identified at the INEL. Big sagebrush, the dominant species, covers approximately 80 percent of the area. The variety of habitats on the INEL support numerous species of reptiles, birds, and mammals. Underlying the INEL are a series of silicic and basaltic lava flows and relatively minor amounts of sedimentary interbeds. The basalts immediately beneath the site are relatively flat and covered with 20 to 30 ft of alluvium. The Snake River Plain Aquifer underlies the INEL and has been designated a sole source aquifer pursuant to the Safe Drinking Water Act.

The TAN complex is located in the northern portion of the INEL and extends over an area of approximately 10 square miles. Access to this area is controlled with fences and security patrols. TAN was built in the early 1950s to support the Aircraft Nuclear Propulsion Program sponsored by the United States Air Force and the Atomic Energy Commission. The Technical Support Facility (TSF) is centrally located within TAN (Figure 1-2), and consists of several experimental and support facilities for conducting research and development activities on reactor performance. The TSF covers an area of approximately 2,200 ft by 1,500 ft and is surrounded by a security fence. Located inside of the TSF fence are 38 buildings and 44 associated structures. The TSF-05 injection well is located in the southwest corner of TSF. Located outside of the fence are parking areas, a helicopter landing pad, rubble piles, a gravel pit, groundwater monitoring wells, surface drainage wells, and a number of roads.

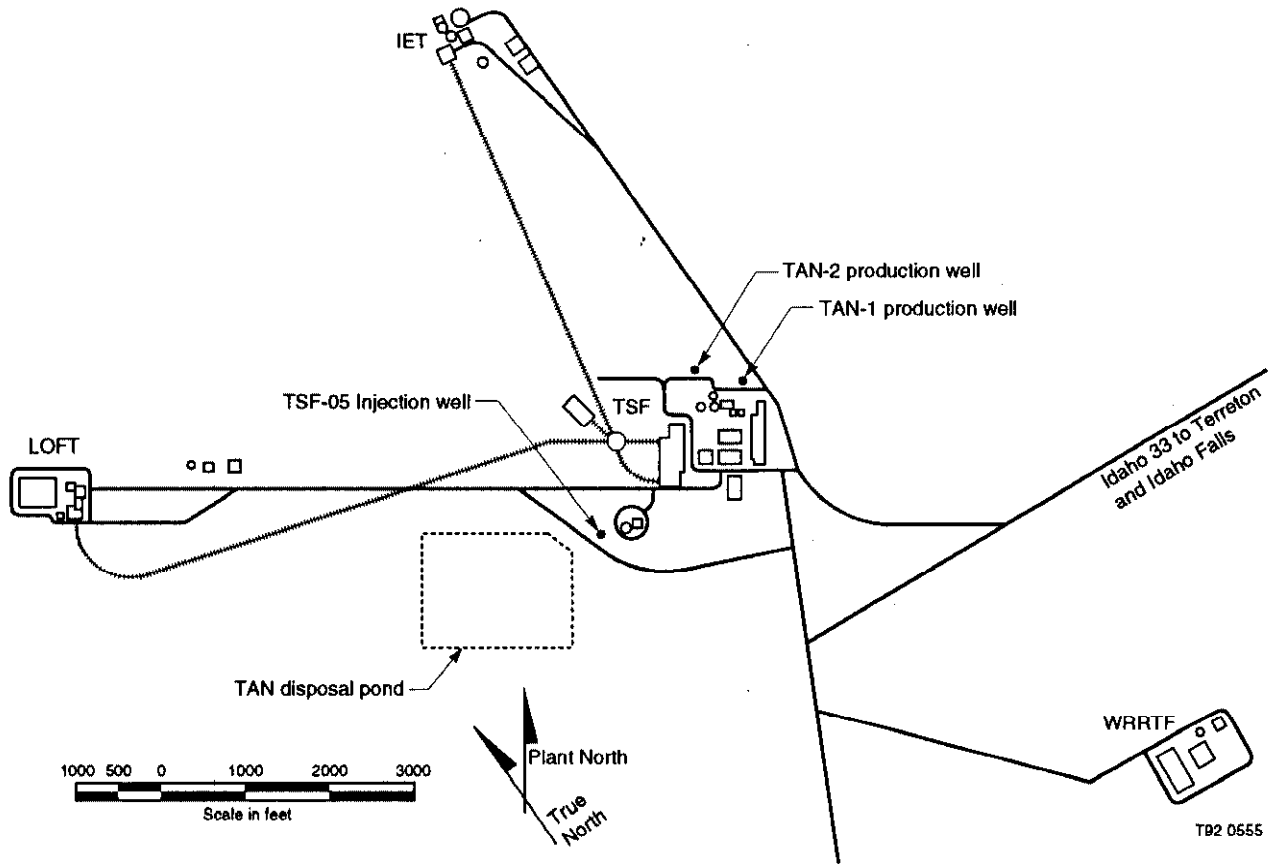

Figure 1-2. Facilities at the Test Area North.

Three other major test facilities are located nearby the TSF and are considered part of the TAN (Figure 1-2). These facilities are the Loss-of-Fluid Test (LOFT) Facility, the Initial Engine Test (IET) facility, and the Water Reactor Research Test Facility (WRRTF).

Most of the INEL is located in the Pioneer Basin, a poorly defined, closed drainage basin. The land surface at TAN is relatively flat except for volcanic vents (buttes) and unevenly surfaced and fissured basalt lava flows. TAN lies in a topographic depression between the base of the Lemhi range to the northwest, the Beaverhead Mountains to the northeast, and the Snake River drainage to the southeast (Figure 1-1). The elevation ranges from a low in this area of 4774 ft on the Birch Creek playa floor to a high of 5064 ft on top of Circular Butte.

The TAN site is at the terminus of the Big Lost River, downgradient of Birch Creek, and upgradient of the terminus of the Little Lost River. These rivers drain mountain watersheds existing to the north and northwest of the INEL. In general, most of the flows from the Big and Little Lost Rivers and Birch Creek are diverted for irrigation purposes before reaching the INEL. On one occasion in the last 40 years Birch Creek actually flowed into the Birch Creek Playa and subsequently infiltrated into the ground. During years of high flow, the Little Lost River also flows on-site. Local rainfall and snowmelt during spring months contributes to recharge of the Snake River Plain Aquifer in the vicinity of TAN.

Two production wells supply water for all operations at the TSF. These wells are located in the northeast corner of the TSF and are identified as TAN-1 and TAN-2 in Figure 1-2. Sampling of the production wells during 1987 confirmed the presence of trichloroethylene (TCE) in concentrations that exceeded maximum contaminant levels (MCL). MCLs are standards established by the EPA and are designed to protect human health from the potential adverse effects of drinking water contaminants. To protect the workers at TAN, an air sparging system was installed in the water supply tank at the TSF to ensure that organic contaminant concentrations remain below regulatory levels (MCLs).

2. SITE HISTORY AND ENFORCEMENT ACTIONS

2.1 Site History

2.1.1 Disposal History of TSF-05 Injection Well

The TSF-05 injection well was completed in 1953 to a depth of 305 ft. The well has a 12-inch-diameter casing with perforations from 180 to 244 ft and from 269 to 305 ft below land surface. The well was used to dispose of TSF industrial and sanitary wastewaters into the Snake River Plain Aquifer which is encountered approximately 200 ft below land surface.

Historical records were reviewed and personnel interviews were conducted as part of previous investigations to determine former waste generation and disposal practices at TAN. These efforts identified six facilities that are potential sources for the groundwater contamination at TAN. Wastes from at least three of these facilities were apparently disposed in the TSF-05 injection well (Table 2-1). In addition, the TSF-05 injection well was also used in the late 1950s and early 1960s to dispose of concentrated evaporator sludges from the processing of low-level radioactive and process wastes at the TSF Intermediate-Level Waste Disposal System (TSF-09). Other types of wastes believed to have been disposed in the TSF-05 injection well include corrosive waste water, ignitable wastes, chromium, lead, and mercury.

The TSF-05 injection well was last used as a disposal site in 1972, after which waste waters were diverted to the southeastern portion of the TAN disposal pond. This well is now securely closed and locked, and the well head is sealed against surface water intrusion.

Table 2-1. Facilities suspected of using the TSF-05 well for waste disposal.

Shop Location	Function	Waste Stream[a]	Time Frame	Treatment/Storage/Disposal
TAN-604	Maintenance shop	Organics and other chemicals	1956-1972	TSF-05 injection well via sewage plant
TAN-607	Chemical cleaning room (pipe laundry)	Corrosive liquids (acids and caustics, but drained separately)	1955-1972	TSF-05 injection well
	Photo lab and cold preparation lab	Corrosive photo developing solution	1955-1972	TSF-05 injection well

a. Accurate disposal and usage records for these materials are not available.

Previous investigations do not provide definitive information on the volumes of organic wastes disposed to the TSF-05 injection well or the specific processes by which they were generated. However, radioactivity released to the TSF-05 injection well can be estimated. The Radioactive Waste Management Information System contains estimates of curies by nuclide released to the TSF-05 injection well for the period of 1971 through August 1972 (Table 2-2, column 2). Records regarding radioactivity released prior to 1971 are not as accurate. Estimates suggest the total radiation released to the TSF-05 injection well from 1959 to 1971 was approximately 45 curies (Ci); however information on the distribution by nuclide during this time period is not available. A rough approximation of nuclide distribution from 1959 to 1971 was calculated in Table 2-2 (column 3) assuming the same distribution as known for 1971 through August 1972, and a total release of 45 Ci.

Potential sources of groundwater contamination at TAN, other than the TSF-05 injection well are not part of this interim action. These other potential sources will be investigated as part of the Waste Area Group (WAG)-wide groundwater Remedial Investigation/Feasibility Study (RI/FS) [Operable Unit (OU) 1-07B] or the comprehensive WAG 1 RI/FS (OU 1-10).

2.1.2 Previous Groundwater Investigations

Contaminants in the TAN groundwater were first detected in April 1987. During groundwater sampling activities, TCE was detected in a sample collected for volatile organic compound (VOC) analyses from TSF production well TAN-1. Subsequent sampling of both production wells (TAN-1 and TAN-2 in Figure 1-2) for VOCs during September and November 1987 confirmed the presence of TCE in both wells and also identified tetrachloroethylene (PCE) in well TAN-1. In addition, independent groundwater sampling at TAN was performed by the USGS in 1987 and 1988. Results from these investigations indicate that well TSF-05 and a nearby observation well (USGS-24, Figure 5-3) were contaminated with TCE and PCE at concentrations in excess of MCLs. Samples from well TSF-05 and the two production wells (TAN-1 and TAN-2) were also tested for selected radionuclides during these sampling efforts. Tritium and Strontium-90 were detected at concentrations in excess of MCLs in samples from well TSF-05. Cesium-137, cobalt-60, americium-241, and plutonium were also detected in well TSF-05; however, there are no MCLs for these analytes.

On the basis of the results from these early sampling efforts, a Resource Conservation and Recovery Act (RCRA) Corrective Action Program was developed to address groundwater contamination at TAN. One of the first actions initiated was the installation of an air sparger in the water supply system in 1989 to keep organic contaminant

Table 2-2. Curies released to the TSF-05 injection well (by nuclide) (1959 through August 1972).

Nuclide	Reported Curies Released (1971 and 1972)	Estimated Curies Released (1959-1970)	Estimated Total Curies Released
Cesium-134	4.6×10^{-3}	2.4×10^{-2}	2.9×10^{-2}
Cesium-137	2.2×10^{-2}	1.2×10^{-1}	1.4×10^{-1}
Strontium-90	8.6×10^{-3}	4.6×10^{-2}	5.4×10^{-2}
Tritium	8.5	44.7	53.2
Unidentified alpha	1.0×10^{-3}	5.5×10^{-3}	6.6×10^{-3}
Unidentified beta and gamma	8.5×10^{-3}	4.5×10^{-2}	5.4×10^{-2}
Yttrium-90	8.6×10^{-3}	4.6×10^{-2}	5.4×10^{-2}
Total	8.5	44.9	53.5

concentrations below safe drinking water levels.

A well drilling and groundwater sampling program from 1989 to 1990, was also initiated which included drilling and sampling 17 new wells (see Figure 5-3), plus sampling another 12 existing wells within 4 miles of the injection well. Additional sampling of production wells, new and existing monitoring wells, and the TSF-05 injection well for organic, inorganic, and radiological constituents occurred during 1989 and 1990 (See Table 5-1 and Figure 5-3). During this sampling period, four contaminants—TCE, PCE, lead, and strontium-90—were consistently detected in more than one well at concentrations exceeding MCLs. These four contaminants are referred to as contaminants of concern, and are the focus of this interim action. Ranges of detected concentrations for the contaminants of concern in the TAN groundwater are presented in Table 2-3.

The USGS also sampled selected new and existing wells for organic and radionuclide constituents in 1989. Analytical results for TCE and PCE from this sampling effort were similar to those presented in Table 5-1, and discussed above. Concentrations of these compounds exceeded MCLs in all wells sampled, with the highest concentrations found in well TSF-05. Tritium concentrations exceeded the MCL in well TSF-05, but were less than the MCL in the other wells sampled. Concentrations of Strontium-90 exceeded the MCL in the TSF-05 injection well and a nearby well (TAN-D2). Elevated concentrations of Cesium-137 were also found in the TSF-05 injection well.

Another action, initiated in 1990, removed and analyzed contaminated sludge that had accumulated in the lower 55 ft of the TSF-05 injection well. Moderate to high concentrations of radionuclides and organic compounds were detected in the sludge. (Table 5-3).

On the basis of the results of the groundwater sampling described above, and from analytical and radiological sampling results of sludge removed from the TSF-05 injection well in 1990 (see Section 5-3), the TSF-05 injection well was determined to be a primary source of groundwater contaminants at TAN.

Table 2-3. Concentration of Groundwater Contaminants of Concern

Contaminants	Concentration[a]	Maximum Contaminant Levels
Trichloroethylene	2 to 1,300 µg/L	5 µg/L
Tetrachloroethylene	2 to 71 µg/L	5 µg/L
Lead	3 to 515 µg/L	50 µg/L
Strontium-90	2 to 470 pCi/L	8 pCi/L

a. Data obtained from sampling a network of 30 wells in the TAN area during late 1989 and 1990. Most of these wells are within 1 mile of the TSF-05 injection well (See Table 5-1 for specific sampling results and Figure 5-3 for well locations). Data obtained from OU 1-07B RI/FS Work Plan, EGG-WM-9098, May 1992.

2.2 Enforcement

A Consent Order/Compliance Agreement (COCA) was entered into between DOE and EPA pursuant to RCRA in August 1987. The COCA required DOE to conduct an initial assessment and screening of all solid waste and/or hazardous waste disposal units at INEL, and resulted in the RCRA Corrective Action Program mentioned in the preceding section.

As a result of the INEL's listing on the NPL in November 1989, DOE, EPA, and the State of Idaho Department of Health and Welfare (IDHW) entered into a Federal Facility Agreement and Consent Order (FFA/CO) pursuant to CERCLA in December 1991. The FFA/CO superseded the COCA and established a procedural framework for agency coordination and a schedule for all CERCLA and RCRA corrective action activities conducted at the INEL. This interim action is undertaken in accordance with this FFA/CO.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

3.1 Community Relations Prior to the Interim Action

In accordance with CERCLA sections 113(K)(2)(b)(i-v) and 117, community interviews were conducted with local officials, community residents, and public interest groups to solicit concerns and information needs, and to learn how and when citizens would like to be involved in the CERCLA process. The information gathered during community interviews and other relevant information provided the basis for development of the INEL-wide Community Relations Plan (CRP). This INEL-wide CRP will continue to be implemented during this interim action to reflect the decision-making process under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and to ensure that appropriate public participation continues under the FFA/CO.

The presence of organic compounds in the groundwater at the TAN was first announced in a news release issued in November 1987. A second news release issued in September 1988, announced both the provision of an alternate source of drinking water for workers at TAN, and the scheduled installation of an air sparging system to remove volatile organic contaminants from the drinking water supply at TAN.

3.2 Community Relations to Support Selection of a Remedy

In accordance with CERCLA sections 113(K)(2)(b)(i-v) and 117, the public was given the opportunity to participate in the remedy selection process.

The Notice of Availability for the Proposed Plan was published January 5, 1992, in the following newspapers:

- *The Post Register* (Idaho Falls),
- *The Idaho State Journal* (Pocatello),
- *Twin Falls Times News*,
- *Idaho Statesman* (Boise),
- *The Lewiston Morning Tribune*,
- *Idaho Free Press* (Nampa),
- *South Idaho Press* (Burley),
- *Moscow-Pullman Daily News*.

A similar newspaper advertisement was published January 30, 1992, in

- *The Post Register* (Idaho Falls),
- *The Idaho State Journal* (Pocatello),
- *Twin Falls Times News*,
- *Idaho Statesman* (Boise),
- *Idaho Free Press* (Nampa),
- the *South Idaho Press* (Burley).

These advertisements repeated the public meeting locations and times. Personal phone calls were made to inform individuals and groups about the comment opportunity. A "Dear Citizen" letter transmitting a copy of the Proposed Plan was mailed January 8, 1992 via a mailing list of 5,731 names of groups and individuals.

The public comment period was initially scheduled from January 13, 1992, to February 12, 1992. Three public meetings were held on February 4, 5, and 6, 1992, in Idaho Falls, Boise, and Burley. Representatives from the DOE, EPA, IDHW, and EG&G Idaho, Inc., were present at the public meetings to discuss the Proposed Plan, answer questions, and receive both written and oral public comments. For one hour prior to each meeting, INEL, EPA, and IDHW representatives were also available for informal discussions with the interested public. A court reporter was present at each meeting to record, verbatim, the proceedings of the meetings. Copies of the transcripts from the public meetings are available for public review in the Information Repositories (which are located at the public libraries in Boise, Twin Falls, Pocatello, Idaho Falls and the University of Idaho library in Moscow) as part of the Administrative Record for this interim action.

A request for an extension of the public comment period was received and granted, therefore extending the comment period to March 13, 1992. A notice of the extension was published February 18 and 19, 1992, in:

- *The Post Register*,
- *The Idaho State Journal*,
- *Twin Falls Times News*,
- *Idaho Statesman*,
- *The Lewiston Morning Tribune*,
- *Idaho Free Press*,
- *South Idaho Press*, and
- *Moscow-Pullman Daily News*.

On March 9, 1992, a technical briefing was conducted with the League of Woman Voters of Moscow via a conference call.

A Responsiveness Summary has been prepared to address public comments as part of this Record of Decision (ROD). All verbal comments given at the public meetings and all submitted written comments are repeated, verbatim, in the Administrative Record for the ROD. Those comments are annotated to indicate which response in the Responsiveness Summary addresses each comment.

In accordance with CERCLA section 113(K)(1), an Administrative Record was established to provide the basis for selection of the remedial action. The Administrative Record is available for public review at the INEL technical library in Idaho Falls. Copies of the Administrative Record are available for public review at the public libraries at Boise, Idaho Falls, Pocatello, and Twin Falls, and the University of Idaho Library in Moscow.

Persons on the mailing list will receive a notice of availability stating that the signed ROD is available. Copies of the ROD and the Responsiveness Summary will be placed in the Administrative Record and in the information repositories, and will be provided to the public upon request.

4. SCOPE AND ROLE OF THE OPERABLE UNIT

The INEL is divided into ten WAGs. The TAN has been designated as WAG 1, which is further divided into ten OUs. The TSF-05 injection well and surrounding groundwater contamination are one of the TAN OUs. It may be appropriate to implement an interim action for an OU before completing the RI/FS. Because sufficient data have been collected regarding the TSF-05 injection well, the OU was further subdivided into OU 1-07A (interim action) and OU 1-07B (TAN groundwater RI/FS).

OU 1-07A, the subject of this ROD, addresses the groundwater contaminants near the TSF-05 injection well. Thus, this interim action will help prevent further degradation of groundwater while the OU 1-07B RI/FS is being completed. During Remedial Design, the engineering phase that follows this ROD, technical drawings and specifications will be developed for the implementation of this interim remedial action.

To the extent practicable, this interim action will facilitate the OU 1-07B RI/FS by providing information about aquifer parameters based on data from the groundwater extraction and monitoring wells. In addition, this interim action will provide site-specific performance information that can be used for evaluating alternative technologies, determining process sizing, and estimating costs. Because this interim action is not the final remedy for the TSF-05 injection well and surrounding groundwater, subsequent investigations are planned to fully address the potential threats posed by the conditions at the site. This interim action will not be inconsistent with nor preclude the implementation of the final response action scheduled to be determined in 1994. In the event that continued operation of this limited scope remedy is determined to be appropriate, operational parameters will be defined in the OU 1-07B ROD.

5. SUMMARY OF SITE CHARACTERISTICS

5.1 Geology

The geology of TAN is characterized by a relatively thin layer (0 to 50 ft) of lacustrine sediments and playa deposits consisting of silts, clays, and minor sands. Underlying the surficial sediments is a thick sequence of basalt flows with sedimentary interbeds. The basalts exhibit a wide range of lithologic textures and structures; from dense to highly vesicular basalt and from massive to highly fractured basalt. Individual flow units consist of a fractured/

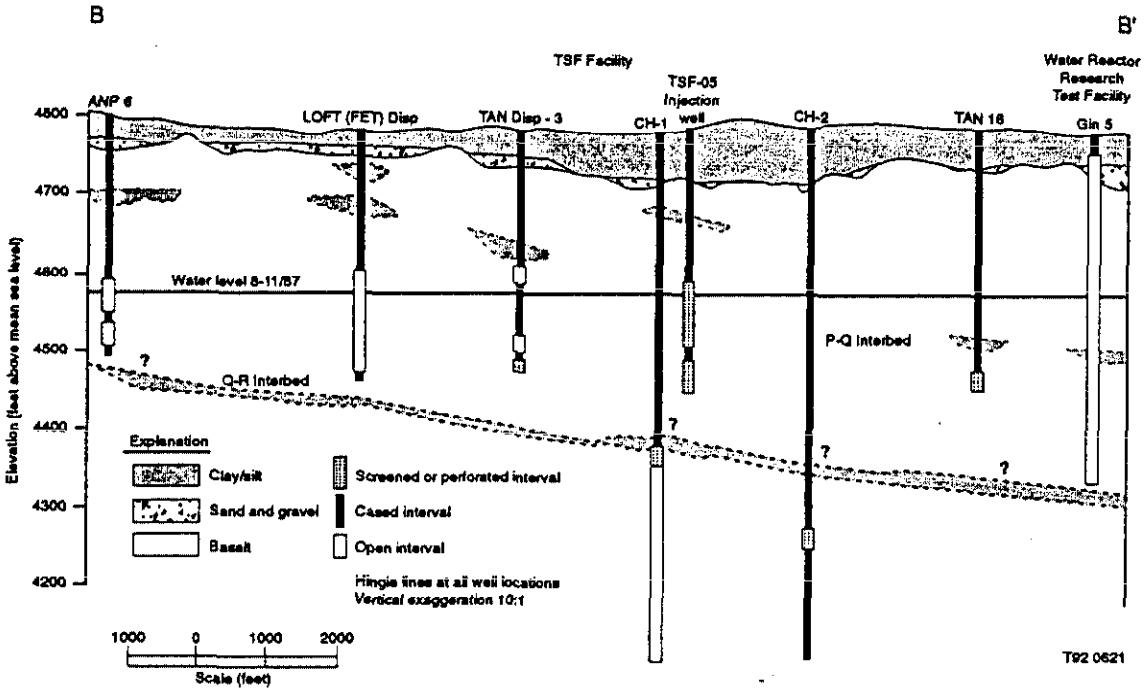

Figure 5-1. Hydrogeological profile of the Test Area North.

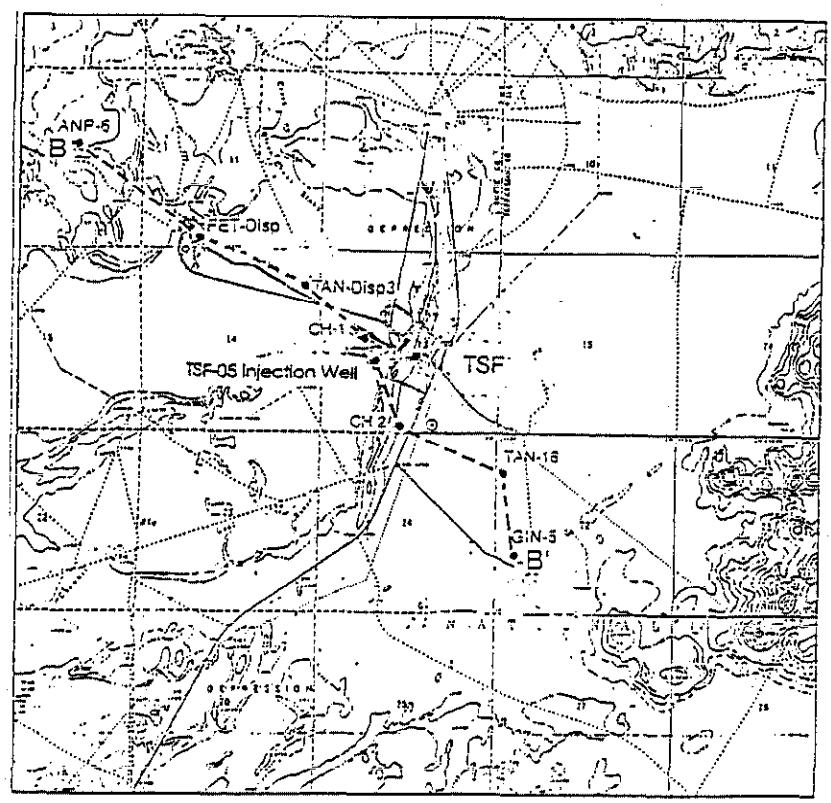

Figure 5-2. Plan view of Test Area North showing the location of cross-section B-B'.

rubbly flow top, a middle dense basalt, and a fractured/rubbly flow bottom. These flow units have a thickness of approximately 15 ft. Sedimentary interbeds occur within the basalt and consist of clay or silt. Interbeds that have been encountered to the maximum depth drilled include the P-Q and Q-R interbeds. Figure 5-1 is a cross-section through TAN. The location of the cross-section is shown in Figure 5-2. The P-Q interbed is discontinuous. The deeper interbed, Q-R, is interpreted to be continuous and slopes to the southeast. It has a variable thickness with a median thickness of approximately 4 ft. Interpretation of hydraulic head data indicates that this interbed could be a continuous, semi-confining layer. Both interbeds and the impact of the TAN geology on remedial alternatives will be evaluated in more detail in the OU 1-07B RI/FS.

5.2 Hydrogeology

The water table underneath the TSF facility averages about 4583 ft above mean sea level [at well United States Geological Survey (USGS)-24] or about 213 ft below land surface with a seasonal variation of about 4 ft. The water table also has a relatively flat horizontal hydraulic gradient (1 ft/mile). In general, the depth to groundwater immediately beneath the land surface at TAN is approximately 200 to 220 ft. The aquifer thickness could be greater than 900 ft. The groundwater flow velocity in the vicinity of TAN is generally south-southeast, and flow velocities range from 0.003 ft/day to 6.0 ft/day, with a median velocity of approximately 0.3 ft/day. Transmissivity estimates range from 400 to 800,000 ft^2/day, with a median transmissivity of approximately 38,000 ft^2/day.

The OU 1-07B RI/FS is investigating whether the Q-R interbed is continuous and creates semi-confining conditions.

Groundwater flow in the vicinity of TAN is south-southeasterly (Figure 5-3) and is influenced by groundwater recharge from the north, northwest, and northeast. Also, the local groundwater flow beneath TAN is affected by pumping from the TSF production wells northeast of the injection well.

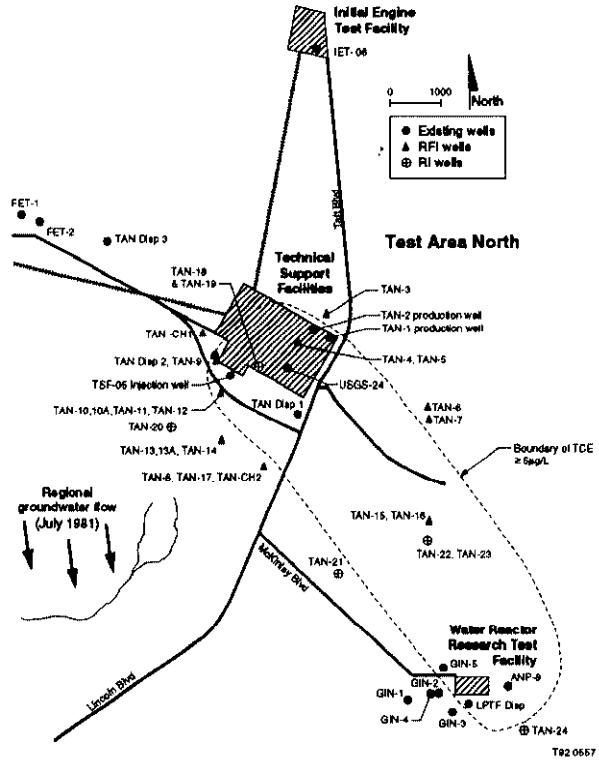

Figure 5-3. Groundwater monitoring wells at the Test Area North.

5.3 Nature and Extent of Contamination

Although there may be other sources, past waste disposal in the TSF-05 injection well is considered to be the principal source of groundwater contamination at TAN. In general, the highest contaminant concentrations were detected in samples from well TSF-05 (Tables 5-1 and 5-2). TCE concentrations ranging from 24,000 µg/L to 35,000 µg/L were detected in groundwater samples collected from the TSF-05 well during 1987 through 1989. Then, in January and February 1990, sludge was removed from the lower 55 linear ft of this well. The sludge was analyzed for total metals, total organics, radionuclides, and Toxicity Characteristic Leachate Procedure (TCLP) metals, organics, pesticides, and herbicides. The concentrations of contaminants detected are presented in Table 5-3. On the basis of the high concentrations of organic and radiological constituents detected in the sludge, this material was considered to be a major source of groundwater contamination in the TSF-05 injection well and the surrounding groundwater. Although there are no additional data at this time, contaminant concentrations in the TSF-05 well are expected to have declined since the sludge was removed. Groundwater sampling associated with the interim action and the OU 1-07B RI/FS will determine current contaminant concentrations in the TSF-05 injection well and other wells at TAN. Also, potential sources of groundwater contamination at TAN other than the TSF-05 injection well will be evaluated under the OU 1-07B RI/FS.

Preliminary interpretations regarding the extent of contamination at TAN are summarized below. These interpretations are based on the previous sampling results presented in Tables 5-1 and 5-2, and will be further evaluated (with new sampling data) as part of the OU 1-07B RI/FS. A groundwater contaminant plume extends generally southeastward from the TSF-05 injection well, which is consistent with the main direction of groundwater flow beneath TAN. Some contaminants have also been detected northeast of well TSF-05; contaminant migration in this direction is probably caused by localized shifts in groundwater flow directions resulting from pumping the TAN production wells (TAN-1 and TAN-2). As stated previously, the contaminants of concern for the interim action include TCE, PCE, lead, and strontium-90. These four contaminants have been detected at varying distances from the TSF-05 injection well, apparently reflecting differing rates of migration through the groundwater. TCE is the most widespread constituent in the contaminant plume, having been found above MCLs as far as 1.5 miles southeast of the TSF-05 well. PCE has been detected in wells as far as 1 mile southeast of the TSF-05 well. Concentrations of strontium-90 and lead above their respective MCLs have only been regularly detected within 1/2 mile of the TSF-05 well.

The vertical extent of groundwater contamination at TAN is not yet clearly defined. Most wells at TAN are screened or open across the water table (which occurs at depths of approximately 200 ft or 4590 ft above mean sea level). The contaminant plume was detected primarily from groundwater samples collected from these wells. The deepest detected contamination was found in a sample from well TAN-12, which is screened at a depth of 362 to 382 ft; approximately 165 ft below the water table at an elevation of 4420 ft above mean sea level. However, there are relatively few wells at TAN which are screened only across deep intervals. Therefore, the vertical extent of contamination is largely unknown. There is no information, for example, to indicate whether contaminants have migrated below the Q-R interbed (Figure 5 -1), which is interpreted to be a semi-confining bed beneath TAN. New wells will be installed as a part of the OU 1-07B RI/FS to help better define the vertical extent of the contaminant plume.

On the basis of the previous sampling data presented in Table 5-1 and discussed above, the contaminant plume beneath TAN is estimated to be approximately 1.5 miles in length, 0.5 miles in width, and 200 ft thick. Although there are numerous uncertainties associated with this estimate (particularly regarding the plume thickness), it is a sufficient initial characterization for interim action design purposes. As stated above, subsequent groundwater sampling for the interim action and the OU 1-07B RI/FS will further refine this initial characterization.

Table 5-1. Groundwater monitoring well data.

Well name	ANP-06[a]	ANP-08	ANP-09[a]	FET-02	IET-06	TAN-01
Screened interval, ft below land surface	230-250	232-304	240-260	215-230	220-240	200-350
Distance from TSF-05, ft	10,630	8420	16,210	4340	6460	2320
When sampled[b]	N/Y/Y	N/Y/Y	N/Y/Y	N/Y/Y	Y/Y/Y	N/Y/Y
Contaminant, µg/L						
Acetone						
Benzene					18/ND/ND	
2-Butanone						
Carbon Disulfide					2/ND/ND	
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Dibromochloromethane						
1,1 Dichloroethane						
1,1 Dichloroethylene						
1,2 Dichloroethane	NA/5/ND					
1,2 Dichloroethylene (total)						
Methylene Chloride						
Tetrachloroethylene		NA/2/3				NA/2/3
Toluene						
1,1,1 Trichloroethane						
Trichloroethylene		NA/6/7				NA/7/8
Vinyl Chloride						
Barium						
Chromium		NA/11/17				
Lead	NA/ND/7	NA/ND/15			8/ND/10	
Mercury						
Gamma, pCi/L					NA/ND/ND	
Strontium-90, pCi/L	NA/ND/2				NA/ND/ND	NA/4/2
Tritium, pCi/L					NA/ND/ND	NA/ND/240

Note: First value given is from March 1989 groundwater monitoring well sampling. Second is from November 1989, and the third is from November 1990. ND is non-detect. NA means a sample wasn't taken from that well in that sampling event. If no data are given, the contaminant has not been detected in that well during the listed sampling events.

a. Wells ANP-06 and ANP-09 are not shown on Figure 5-3. ANP-06 is 10,630 feet northwest of TSF-05. ANP-09 is 16,210 ft southeast of TSF-05.

b. Indicates when each well was sampled (i.e. Y/Y/Y means the well was sampled in March 1989, November 1989, and November 1990).

Table 5-1. (continued).

Well name	TAN-02	TAN-03	TAN-04	TAN-05	TAN-06	TAN-07
Screened interval, ft below land surface	235-335	230-235	235-240	280-285	235-255	298-318
Distance from TSF-05, ft	1930	2340	1410	1380	4990	5000
When sampled[b]	N/Y/Y	N/Y/Y	N/Y/Y	N/Y/Y	N/N/Y	N/N/Y
Contaminant, µg/L						
Acetone				NA/72/ND		
Benzene						
2-Butanone				NA/6/ND		
Carbon Disulfide						
Carbon Tetrachloride						
Chloroform						
Chloromethane						
Dibromochloromethane						
1,1 Dichloroethane						
1,1 Dichloroethylene						
1,2 Dichloroethane						
1,2 Dichloroethylene (total)						
Methylene Chloride						
Tetrachloroethylene			NA/20/24	NA/16/28		
Toluene						
1,1,1 Trichloroethane			NA/3/3	NA/ND/2		
Trichloroethylene	NA/3/2		NA/70/73	NA/71/100		
Vinyl Chloride						
Barium						
Chromium			NA/10/ND			
Lead		NA/80/5	NA/21/ND	NA/ND/15		
Mercury		NA/5/ND	NA/ND/0.3			
Gamma, pCi/L						
Strontium-90, pCi/L	NA/4/NA			NA/ND/6	NA/NA/13	NA/NA/1
Tritium, pCi/L			NA/900/ 1000	NA/1700/ 1100		

Note: First value given is from March 1989 groundwater monitoring well sampling. Second is from November 1989, and the third is from November 1990. ND is non-detect. NA means a sample wasn't taken from that well in that sampling event. If no data are given, the contaminant has not been detected in that well during the listed sampling events.

b. Indicates when each well was sampled (i.e. Y/Y/Y means the well was sampled in March 1989, November 1989, and November 1990).

Table 5-1. (continued).

Well name	TAN-08	TAN-09	TAN-10	TAN-10A	TAN-11	TAN-12
Screened interval, ft below land surface	232-304	290-295	220-225	215-250	260-265	362-382
Distance from TSF-05, ft	2180	90	210	180	250	290
When sampled[b]	N/Y/Y	N/Y/Y	N/Y/N	N/Y/Y	N/Y/Y	N/Y/Y
Contaminant, µg/L						
Acetone	NA/61/ND					
Benzene						
2-Butanone						
Carbon Disulfide						
Carbon Tetrachloride			NA/6/NA			
Chloroform						
Chloromethane						NA/NA/1
Dibromochloromethane						
1,1 Dichloroethane						
1,1 Dichloroethylene						
1,2 Dichloroethane						
1,2 Dichloroethylene (total)		NA/ND/2				
Methylene Chloride						
Tetrachloroethylene		NA/17/20	NA/11/NA	NA/7/6	NA/27/21	NA/NA/13
Toluene	NA/1/ND		NA/1/NA			
1,1,1 Trichloroethane			NA/1/NA			
Trichloroethylene		NA/86/90	NA/28/NA	NA/26/18	NA/89/75	NA/NA/39
Vinyl Chloride						
Barium		NA/270/303	NA/238/NA	NA/NA/238		
Chromium						
Lead	NA/ND/28	NA/4/10	NA/8/NA	NA/NA/15	NA/5/ND	
Mercury						
Gamma, pCi/L						
Strontium-90, pCi/L	NA/ND/10	NA/15/27	NA/76/NA	NA/NA/470	NA/6/3	
Tritium, pCi/L		NA/8000/ 6900	NA/2800/ NA	NA/NA/ 3600	NA/3500/ 3300	NA/NA/ 1800

Note: First value given is from March 1989 groundwater monitoring well sampling. Second is from November 1989, and the third is from November 1990. ND is non-detect. NA means a sample wasn't taken from that well in that sampling event. If no data are given, the contaminant has not been detected in that well during the listed sampling events.

b. Indicates when each well was sampled (i.e. Y/Y/Y means the well was sampled in March 1989, November 1989, and November 1990).

Table 5-1. (continued).

Well name	TAN-13A	TAN-14	TAN-15	TAN-16	TAN-17	TAN-D1	TAN-D2
Screened interval, ft below land surface	216-236	376-396	232-252	302-322	320-340	230-235	230-235
Distance from TSF-05, ft	1370	1420	5720	5750	2200	1940	115
When sampled[b]	N/N/Y	N/N/Y	N/N/Y	N/N/Y	N/N/Y	Y/Y/Y	Y/Y/Y
Contaminant, µg/L							
Acetone						6/ND/ND	
Benzene							
2-Butanone							
Carbon Disulfide							3/ND/ND
Carbon Tetrachloride							
Chloroform							
Chloromethane							
Dibromochloromethane							ND/5/ND
1,1 Dichloroethane							
1,1 Dichloroethylene							
1,2 Dichloroethane							
1,2 Dichloroethylene (total)						ND/2/2	ND/85/14
Methylene Chloride							
Tetrachloroethylene			NA/NA/8	NA/NA/9		6/23/19	10/11/8
Toluene	NA/NA/1						
1,1,1 Trichloroethane							
Trichloroethylene			NA/NA/32	NA/NA/41		39/150/140	170/660/240
Vinyl Chloride							
Barium					NA/NA/200		286/312/280
Chromium		NA/NA/20	NA/NA/21	NA/NA/12	NA/NA/45		
Lead		NA/NA/13			NA/NA/18	7/ND/11	10/8/515
Mercury							
Gamma, pCi/L						NA/ND/ND	NA/ND/ND
Strontium-90, pCi/L	NA/NA/2	NA/NA/5		NA/NA/13	NA/NA/20	NA/ND/ND	NA/230/29
Tritium, pCi/L			NA/NA/330	NA/NA/320		NA/2000/ 1900	NA/4400/ 3100

Note: First value given is from March 1989 groundwater monitoring well sampling. Second is from November 1989, and the third is from November 1990. ND is non-detect. NA means a sample wasn't taken from that well in that sampling event. If no data are given, the contaminant has not been detected in that well during the listed sampling events.

b. Indicates when each well was sampled (i.e. Y/Y/Y means the well was sampled in March 1989, November 1989, and November 1990).

Table 5-1. (continued).

Well name	TAN-D3	USGS-24	USGS-26	GIN-2	GIN-4	TSF-05[a]
Screened interval, ft below land surface	230-235	240-245	205-260			230-240
Distance from TSF-05, ft	3160	1410	14,970	7700	7680	—
When sampled[b]	N/Y/Y	Y/Y/Y	N/Y/Y	N/N/Y	N/N/Y	Y/N/N
Contaminant, µg/L						
Acetone		18/ND/ND				
Benzene						4/NA/NA
2-Butanone						
Carbon Disulfide						
Carbon Tetrachloride						
Chloroform		ND/1/ND				
Chloromethane						
Dibromochloromethane						
1,1 Dichloroethane		ND/2/1				
1,1 Dichloroethylene		ND/9/7				23/NA/NA
1,2 Dichloroethane						
1,2 Dichloroethylene (total)		4/44/47				7800/NA/NA
Methylene Chloride						
Tetrachloroethylene		19/71/51		NA/NA/2	NA/NA/1	53/NA/NA
Toluene			NA/6/ND			
1,1,1 Trichloroethane		ND/12/11				
Trichloroethylene		210/1300/720		NA/NA/3	NA/NA/2	28000/NA/NA
Vinyl Chloride						25/NA/NA
Barium		201/204/220				148/NA/NA
Chromium						
Lead	NA/7/5	9/14/8		NA/NA/44		14/NA/NA
Mercury						0.3/NA/NA
Gamma, pCi/L		NA/ND/ND				NA/NA/NA
Strontium-90, pCi/L		NA/ND/11				NA/NA/NA
Tritium, pCi/L		NA/9800/8300				NA/NA/NA

Note: First value given is from March 1989 groundwater monitoring well sampling. Second is from November 1989, and the third is from November 1990. ND is non-detect. NA means a sample wasn't taken from that well in that sampling event. If no data are given, the contaminant has not been detected in that well during the listed sampling events.

a. The data given for the TSF-05 well represent groundwater conditions near the well in March 1989 before the sludge was removed from the bottom of the well in January and February 1990.

b. Indicates when each well was sampled (i.e. Y/Y/Y means the well was sampled in March 1989, November 1989, and November 1990).

Table 5-2. Maximum detected concentrations of contaminants detected by the USGS in groundwater samples at TAN 1987-1989.

Well ID	Analyte	Maximum Detected Concentration
		(µg/L)
TSF-05	TCE	35,000
TSF-05	PCE	170
		(pCi/L)
TSF-05	Strontium-90	1,930 +/- 50
TSF-05	Tritium	43,200 +/- 1,000
TSF-05	Cesium-137	7,500 +/- 200
TSF-05	Plutonium-238	1.22 +/- .09
TSF-05	Plutonium-239, -240	5 +/- .2
TSF-05	Cobalt-60	890 +/- 90
TSF-05	Americium-241	0.21 +/- .04

These data represent conditions before sludge was removed from the well (refer to Section 2.1.2).

5.4 TAN Disposal Pond Data

The TAN disposal pond is an unlined, diked area built in 1972 that encompasses approximately 35 acres. Access to the entire 35 acre pond is restricted by a fence. Approximately 4 acres in the northeast and eastern edges of the large disposal pond are currently in use. The remaining 31 acres are inactive (dry) and have apparently never been used for any disposal operations. Review of historical records and aerial photographs, interviews with former employees, and a site inspection provided no evidence of former discharges or other waste disposal operations in this 31 acres of the pond. Therefore, this part of the disposal pond is considered to be uncontaminated.

The active area of the pond consists of two lagoons—a main lagoon and an overflow lagoon—which receive approximately 40,000 to 70,000 gallons per day (gpd) of process waste water and treated sewage effluent. The main lagoon and the overflow lagoon are located along the eastern and northeastern edges of the disposal pond, respectively. Both of the lagoons are bermed to contain the discharge effluent within these portions of the large disposal pond. Some soil contamination, resulting from past activities at TAN, has been detected in the lagoons and immediate vicinity. Detected contaminants include organic compounds, radionuclides, and heavy metals. Contaminant concentrations are highest in the upper soil layers and typically decrease with depth. In general, the highest concentrations and frequency of detection were found in the main discharge lagoon. A perched water zone exists in the vicinity of the active lagoons and was routinely monitored by sampling two monitoring wells located along the northeastern and eastern edges of the 35 acre disposal pond. No contaminants have been routinely detected above MCLs in samples from these wells.

In summary, on the basis of the above information, most of the 35 acre disposal pond is considered to be uncontaminated. Some soil contamination is associated with the active lagoons along the northeastern and eastern edges of the disposal pond. However, this contamination is localized in the upper soil layers in and adjacent to the active lagoons and does not appear to be migrating to other portions of the large disposal pond. The nature and extent of existing contamination in the TAN disposal pond will be further evaluated under OU 1-06 of the FFA/CO.

Table 5-3. Maximum contaminant concentration in TSF-05 injection well sludge.[a]

Substance	Concentration (with units)
1,1 dichloroethylene	24 µg/gm[c]
Methylene chloride	290 µg/l[b]
trans-1,2-dichloroethylene	410 µg/gm[c]
Trichloroethylene	30,000 µg/gm[c]
Tetrachloroethylene	2,800 µg/gm[c]
2-butanone (Methyl Ethyl Ketone)	180 µg/gm
Barium (total)	326 µg/gm
Lead (total)	180 µg/gm
Chromium (total)	91 µg/gm
Mercury (total)	101 µg/gm
Gross beta[d]	4,900,000 pCi/L[e]
Gross alpha[d]	6,000 pCi/L[e]
Cobalt-60	812 pCi/gm
Cesium-137	2,540 pCi/gm
Europium-154	6.6 pCi/gm
Americium-241	23.6 pCi/gm
Tritium	1,000,000 pCi/L[e]
Plutonium-239	12.2 pCi/gm

a. Data were taken from the OU 1-07B TAN groundwater RI/FS workplan. Appendix B and Appendix G.

b. TCLP extraction results for leachable VOCs.

c. Total VOCs.

d. The percentage of gross beta which is strontium-90 has not been determined.

e. These samples were obtained from water decanted or liquid extracted from the sludge.

6. SUMMARY OF SITE RISKS

6.1 Human Health

Although this interim action does not use a completed baseline risk assessment, sufficient information is available to demonstrate the potential for risk and the need to take action.

Chemical-specific standards that define acceptable risk levels such as MCLs, may be used to determine whether an exposure is associated with an unacceptable risk to human health or the environment and whether remedial action is warranted. Four contaminants have been found to exceed their chemical-specific MCLs in more than one well and on a recurring basis in the vicinity of the TSF-05 injection well and therefore are considered to be contaminants of concern. Table 6-1 identifies the contaminants of concern, their respective MCLs, and risk-based concentrations.

Both trichloroethylene and tetrachloroethylene have been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time.

Lead can cause a variety of adverse health effects in humans. At relatively low levels of exposure, these effects may include interference with red blood cell chemistry, delays in normal physical and mental development in babies and young children, slight deficits in the attention span, hearing, learning abilities of children, and slight increases in the blood pressure of some adults.

Strontium-90 is a fission product and a beta particle emitter. Strontium-90 accumulates in bone tissue and if taken internally, can damage the bone marrow and bone tissue which can cause cancer. Children are more susceptible to impacts from the strontium-90 because their bones are developing more rapidly than in an adult. Beta particles can penetrate the skin, so these particles can also damage the skin and eyes.

The potentially exposed populations include site workers and site visitors. The reasonable exposure pathways for each group are ingestion of contaminated groundwater and inhalation of volatiles. The immediate threat of exposure has been mitigated by the installation of an air sparger system in the drinking water supply. Although the air sparger reduces the risk of exposure, it does not address the source of groundwater contamination or the protection of future drinking water supplies. For a future residential scenario where people might live on part of the INEL, a drinking water well could draw contamination from a portion of the contaminant plume.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing this interim action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

A quantitative human health risk assessment will be included as part of OU 1-07B RI/FS.

6.2 Ecological Risk Assessment

An ecological risk assessment was not performed for this interim action. A quantitative ecological assessment will be performed as part of the INEL-wide comprehensive RI/FS scheduled for 1998.

Table 6-1. Contaminants of concern, their respective MCLs, and risk-based concentrations.[a]

		Risk-based concentrations			
Chemical	MCL (µg/L)	Risk at MCL	Risk=10-6 (µg/L)	Risk=10-4 (µg/L)	HI=1 (µg/L)
Trichloroethylene	5	2.0E-6	3	300	NA
Tetrachloroethylene	5	2.0E-6	1	100	400
Lead	50	NA	NA	NA	NA
Radionuclides	MCL (pCi/L)		(pCi/L)	(pCi/L)	(pCi/L)
Strontium-90	8	1.0E-5	0.60	60	NA

a. The data that support this list of contaminants are contained in Table 5-1. The contaminants were taken from validated data from 1989 and 1990 groundwater sampling and include only those contaminants that were found in both years. Contaminants that were not found above MCLs in more than one well and on a recurring basis were not included in this list.

7. DESCRIPTION OF ALTERNATIVES

Four alternatives were considered for this interim action: (1) no action; (2) groundwater extraction and treatment by air stripping, carbon adsorption, and ion exchange; (3) groundwater extraction and treatment by carbon adsorption and ion exchange; and (4) groundwater extraction and treatment by chemical destruction and ion exchange. These four alternatives are discussed in greater detail below.

7.1 Common Features

Each of the alternatives, except for the no action alternative, have the following common features:

- Will operate for a maximum of two years.
- Will pump at an average rate of approximately 50 gallons per minute (gpm) and occasional rates of 10 to 100 gpm.
- Will achieve performance standards (given in Table 9-2) for contaminants of concern in the treated groundwater effluent.
- Groundwater monitoring wells within the contaminant plume will monitor the effectiveness of the interim action in reducing contaminant concentrations in the groundwater. These wells may also be used as extraction wells to expedite the removal of contaminated groundwater.
- Include installing on-site groundwater treatment facilities to remove contaminants from the groundwater. The treated effluent will be discharged to the TAN disposal pond.
- Existing institutional controls such as the air sparger and monthly drinking water monitoring program will continue. New administrative and institutional controls will be implemented as appropriate to supplement engineering controls and minimize exposure to releases of hazardous substances during remediation.

7.2 Alternatives

7.2.1 Alternative 1: No Action

The NCP requires that the "no-action" alternative be considered for every site to determine a baseline against which other remedial alternatives can be measured. Under this alternative, no remedial actions would be taken beyond those already in place such as the air sparging system. The monthly drinking water program would continue and groundwater monitoring would be implemented to evaluate changes in the contaminant plume.

7.2.2 Alternative 2: Groundwater Extraction and Treatment by Air Stripping, Carbon Adsorption, Ion Exchange

This alternative differs from the no action alternative because active measures would be taken to reduce the contaminants near the TSF-05 injection well and in the surrounding groundwater, which would reduce the threat to drinking water supplies and help prevent further degradation of groundwater while the OU 1-07B RI/FS is being completed. Alternative 2 employs well-established and widely used technologies.

Groundwater will be extracted from the TSF-05 injection well and perhaps nearby groundwater monitoring wells that are capable of capturing contaminated groundwater. The extracted groundwater would be pumped to an on-site facility comprised of: a filtration system to remove sediment, an air stripper equipped with a carbon scrubber to remove organic contaminants; and an ion exchange system to remove inorganics and radionuclides. The filtration system is a physical process that removes suspended solids from the groundwater. This system could be a tank where solids are allowed to settle out of the groundwater or a porous media such as sand or paper that captures the solid particles as the groundwater passes through the filter. Sediment would be analyzed for hazardous and radioactive contaminants and will be disposed of as identified in Table 9-1.

Air stripping is a mass transfer process in which volatile contaminants in water are transferred to gas. Air stripping is frequently accomplished in a packed tower equipped with an air blower. In this type of system, water flows down through a packing material that produces a large surface area for gas transfer, while air flows upward, and is exhausted through the top. Because volatile contaminants such as TCE and PCE have a relatively high vapor pressure, they readily leave the aqueous stream for the gas phase. Air flowing through the top of the air stripper would pass through an activated carbon treatment system to capture the organic contaminants released from the groundwater. The activated carbon would selectively adsorb the contaminants by a surface attraction phenomenon in which the organic molecules are attracted to unsatisfied electrostatic charges on and in the pores of the carbon granules. Air from the air stripper may also be passed through a filter to remove solid particles, radioactive particles, and water mists that might be generated from the air stripper. Air emissions would be monitored for compliance with regulatory standards for air pollutants. The carbon treatment system would be monitored for contaminant breakthrough, and as necessary, the carbon would be replaced. The spent carbon would be regenerated at a facility operating in compliance with EPA's Revised Procedures for Planning and Implementing Off-Site Response Actions.

In addition to passing through the air stripper, the groundwater would also pass through one or more ion exchange columns. Ion exchange is a process whereby the dissolved metals and radionuclides are removed from the groundwater by being exchanged with relatively harmless ions held by the ion exchange material. Ion exchange resins are primarily synthetic organic materials containing ionic functional groups to which exchangeable ions are attached. Although specific ion exchange and sorptive resins systems must be designed on a site-specific basis, typical configurations include parallel columns to allow for one or more columns to be taken out for regeneration while the remaining columns would stay in service. Procedures for recovery or regeneration of the spent resins would be determined during remedial design. It is anticipated that the spent resins would be disposed of in available storage areas at the Radioactive Waste Management Complex (RWMC) at the INEL as low-level radioactive waste.

The treated effluent would be monitored for treatment efficiency prior to discharge to the TAN disposal pond, where the effluent would evaporate and percolate into the ground.

7.2.3 Alternative 3: Groundwater Extraction and Treatment by Carbon Adsorption and Ion Exchange

Although the purpose of this alternative is the same as Alternative 2, a different groundwater treatment system is proposed which uses activated carbon as the primary treatment technology for the removal of organic contaminants. The remedial objective, filtration, ion exchange, and effluent disposal systems remain the same, but an activated carbon system would replace the air stripper and associated offgas treatment system. Activated carbon is a technology that is adaptable for the removal of organic and inorganic contaminants from both air and aqueous wastes. Alternative 3 employs well-established and widely used technologies.

Following pretreatment by the filtration system, the contaminated groundwater would be passed through several carbon adsorption columns where the carbon would selectively adsorb the organic contaminants. In addition, the water would also pass through ion exchange columns to remove inorganic contaminants and radionuclides. Use of several carbon adsorption columns would provide considerable flexibility. Various columns could be arranged in series to increase service life between regeneration or in parallel for maximum hydraulic capacity. The piping arrangement would also allow for one or more beds to be regenerated while the other columns remain in service.

The disposal of the sediment and spent resins would be the same as for Alternative 2. Spent organic carbon under this alternative could contain organic and inorganic contaminants as well as radionuclides. In this instance, the spent carbon could be classified as a combustible mixed waste that would require disposal on-site at the Waste Experimental Reduction Facility (WERF) or similar facility.

7.2.4 Alternative 4: Groundwater Extraction and Treatment by Chemical Destruction and Ion Exchange

Although the purpose of this alternative is the same as Alternatives 2 and 3, a different groundwater treatment system is proposed. The remedial objective, filtration, ion exchange, and effluent disposal systems remain the same, but a chemical treatment system would replace the air stripping or activated carbon systems.

Following pretreatment by the filtration system, the contaminated groundwater would be passed through a chemical treatment system to destroy the organic contaminants, and an ion exchange column to remove inorganic contaminants and radionuclides. The chemical treatment system would detoxify organic contaminants by actually changing their chemical forms from complex organic molecules to simple, more benign molecules by using ultraviolet light and either ozone or hydrogen peroxide. The ultraviolet light provides an energy source to break chemical bonds while the ozone or hydrogen peroxide provides an oxygen atom to form benign compounds.

The disposal of sediments and spent resins would be the same as Alternative 2. Treatment residuals contaminated with organic compounds would not be generated and would not need to be disposed.

8. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives for the TSF-05 injection well and surrounding groundwater interim action were compared according to nine criteria developed on the basis of the statutory requirements of CERCLA Section 121 and the NCP. These evaluation criteria are shown below and discussed in the following sections.

- Threshold criteria
  - Overall protection of human health and the environment
  - Compliance with applicable or appropriate and relevant requirements (ARARs)

- Primary balancing criteria

  - Long-term effectiveness and permanence
  - Reduction of toxicity, mobility, or volume through treatment
  - Short-term effectiveness
  - Implementability
  - Cost

- Modifying criteria

  - State acceptance
  - Community acceptance.

A summary of the comparative analysis of alternatives is shown in Table 8-1.

8.1 Threshold Criteria

8.1.1 Overall Protection of Human Health and the Environment

This criterion measures how the alternative, as a whole, achieves and maintains protection of human health and the environment within the scope of this action. Alternative 1 is not protective of human health and the environment. It neither reduces the threat of exposure to drinking water supplies nor prevents further degradation of the groundwater. Alternatives 2, 3, and 4 are protective of human health and the environment. Each alternative reduces the risk to potentially exposed populations and prevents further degradation of the groundwater.

8.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

This evaluation criterion is used to determine whether each alternative will meet all of the Federal and State ARARs that have been identified for this interim action. Compliance with an ARAR as an evaluation criteria is not applied to Alternative 1, the baseline alternative. Alternatives 2, 3, and 4 achieve compliance with the ARARs. This analysis is summarized in the Statutory Determinations section.

8.2 Primary Balancing Criteria

8.2.1 Long-Term Effectiveness and Permanence

The evaluation of alternatives under this criterion, the results of a remedial action in terms of the risk remaining at the site after response objectives have been met and the extent and effectiveness of the controls that may be required to manage treatment residuals are addressed. Because the spent carbon produced by Alternative 2 would be regenerated off-site, Alternative 2 would provide a higher degree of long-term effectiveness and permanence than Alternatives 3 or 4. Alternative 3 is less reliable because of the necessity of long-term management controls for providing continued protection from potential mixed-waste residuals. Alternative 4 is less reliable because of the uncertainties associated with long-term operation and maintenance functions.

8.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

This evaluation criteria addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. Alternatives 2, 3, and 4 reduce the mobility and volume of contaminants in the groundwater

Table 8-1. Comparative Evaluation of Alternatives.

Interim Action Alternatives Evaluation Criteria	Alternative #1: No Action[a]	Alternative #2: Extraction and Treatment by Air Stripping, Carbon Adsorption, and Ion Exchange	Alternative #3: Extraction and Treatment by Carbon Adsorption and Ion Exchange	Alternative #4: Extraction and Treatment by Chemical Destruction and Ion Exchange
Protection of Human Health and the Environment	Does not satisfy	Satisfies	Satisfies	Satisfies
Compliance with ARARs	Does not satisfy	Satisfies	Satisfies	Satisfies
Long-term Effectiveness		✪	✧	✦
Reduction of Toxicity, Mobility, or Volume Through Treatment		✪	✧	✪
Short-term Effectiveness		✪	✦	✧
Implementability		✦	✪	✧
Cost		✧	✦	✪
State Acceptance		✪	✧	✦
Community Acceptance		✪	✦	✦

✧ = Poor ✦ = Good ✪ = Best

a. Since the no action alternative does not meet the first two threshold criteria, it was not considered any further in the evaluation.

due to extraction. Alternative 2, through the regeneration of spent carbon by incineration, and Alternative 4, through chemical destruction, result in the greatest amount of organic contaminants destroyed. Alternative 3 poses a greater risk than Alternatives 2 and 4 because the treatment residues would have to be handled as a mixed waste.

8.2.3 Short-Term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until remedial response objectives are met. Alternatives 2, 3, and 4 could not begin operation until 1993, to allow sufficient time for design and construction of the treatment facilities. Alternatives 2 and 3 would require less time to achieve protection because they are proven technologies with documented performance data, and would use readily available systems. Alternative 4 would require more time to design and achieve full-scale operation.

Alternatives 2, 3, and 4 are not expected to pose significant risks to workers during construction. Short-term risks to workers, such as exposure to contaminants during installation of groundwater monitoring wells, could be mitigated by engineering controls and standard health and safety practices. Alternatives 2, 3, and 4 are not expected

to pose significant risks of exposure to workers during the handling and transportation of wastes. Short-term risks could be mitigated by engineering controls and standard health and safety practices. Alternative 2 is not expected to pose a significant risk of exposure to the community during transportation of spent carbon to a recycling facility or during regeneration of the carbon by incineration. Organic contaminants would be bound to the carbon during transport and not subject to rapid release in the event of an accident. Incineration would occur at an EPA-approved facility designed to safely handle the contaminated carbon. Short-term risks could similarly be mitigated by engineering controls and standard health and safety practices. Alternative 4 has the disadvantage of requiring more extensive bench- or pilot-scale studies than the other alternatives before a larger scale treatment system could be designed. In addition, this alternative would require more complex technology, which would increase the risk to the workers and the environment if a failure occurred.

8.2.4 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative as well as various services and materials required during its implementation. Alternatives 2 and 3 employ well-established technologies that are widely used in the treatment of hazardous waste streams. Air stripping, carbon adsorption, and ion exchange are easily integrated into complex treatment systems. Alternative 4 includes chemical oxidation to destroy organic contaminants. Treatability studies are necessary to demonstrate the applicability and performance of this technology for a specific site; and therefore, the technical uncertainties associated with design and construction may hinder implementation. The necessary equipment and specialists as well as services and materials are expected to be readily available for each alternative. From the perspective of waste treatment and disposal, Alternative 3 would be more difficult to implement than Alternative 2 which would be more difficult than Alternative 4. Alternative 3 would be difficult to implement because it is possible that a mixed waste would be generated and treatment and disposal options for mixed waste are very limited. Alternative 2 would be more difficult to implement than Alternative 4 because spent carbon would need to be transported off-site for regeneration. Alternative 4 would be the most implementable from a waste treatment and disposal perspective because no mixed or hazardous waste would be generated.

8.2.5 Cost

The evaluation of alternatives under this criteria includes capital costs and annual operation and maintenance costs. Alternative 3, estimated at $7,440,000, is the least expensive of the treatment alternatives. Alternative 4 is estimated at $7,360,000, followed by Alternative 2 at $7,715,000. A summary breakdown of these costs for each alternative is shown in Table 8-2.

8.3 Modifying Criteria

8.3.1 State Acceptance

This assessment criterion evaluates the technical and administrative issues and concerns the IDHW may have regarding each of the alternatives. The IDHW concurs with the preferred remedial alternative. The IDHW has been involved with the development and review of the Proposed Plan, Record of Decision, and other project activities such as public meetings.

8.3.2 Community Acceptance

This assessment evaluates the issues and concerns the public may have regarding each of the proposed alternatives. On the basis of verbal comments received during the public meeting held February 4, 5, and 6, 1992 and written comments received during the comment period ending March 13, 1992, the community appears to accept the

Table 8-2. Cost breakdown for the alternatives.

Activity	Costs, $		
	Alternative 2 Treatment by Air Stripping, Carbon Adsorption, Ion Exchange	Alternative 3 Treatment by Carbon Adsorption and Ion Exchange	Alternative 4 Treatment by Chemical Destruction and Ion Exchange
Facility Design[1]	600,000	600,000	650,000
Well Drilling[2]			
Well Conversion	207,000	207,000	207,000
Monitoring Wells	226,000	226,000	226,000
Waste Disposal	42,000	42,000	42,000
Subtotal	475,000	475,000	475,000
Plant Costs			
Building, piping	575,000	575,000	575,000
Process Equipment	975,000	655,000	520,000
Start-up Pump Test	166,000	166,000	166,000
Field Supervision	132,000	132,000	132,000
Subtotal	1,848,000	1,528,000	1,393,000
2-yr Operating Costs			
Operating Labor	1,188,000	1,188,000	1,400,000
Technical Support	176,000	176,000	176,000
Supplies/Material	520,000	460,000	480,000
Analytical Costs	520,000	520,000	520,000
Waste Disposal	320,000	480,000	280,000
Project Supervision	470,000	470,000	470,000
Subtotal	3,194,000	3,294,000	3,326,000
Plant Decontamination	176,000	176,000	176,000
Contingency[3]	1,422,000	1,367,000	1,340,000
Total	7,715,000	7,440,000	7,360,000

1. Design includes costs ($25,000 for Alternatives 2 and 3, and $50,000 for Alternative 4) for the small-scale design studies needed to improve actual performance of the treatment plant.

2. Well drilling could include conversion of five existing wells to monitoring wells, drilling of two new monitoring wells near the TSF-05 injection well, and waste treatment and disposal. These wells would be in addition to the wells drilled under the RI/FS.

3. Contingency (25%) covers uncertainties in construction and operating costs only.

preferred remedial alternative. Specific responses and comments to the remedial alternatives may be found in the attached Responsiveness Summary (Appendices A and B).

9. SELECTED REMEDY

On the basis of consideration of the requirements of CERCLA, the detailed analysis of the alternatives using the nine criteria, and public comments, DOE, EPA, and IDHW have determined that Alternative 2 (Groundwater Extraction and Treatment by Air Stripping, Carbon Adsorption, and Ion Exchange) is the most appropriate remedy for OU 1-07A.

The objectives of the interim action are twofold:

- Reduce the contaminants near the TSF-05 injection well and in the surrounding groundwater.
- Measure aquifer parameters based on data from the groundwater extraction and monitoring wells.

Removing contaminants will help prevent further degradation of groundwater while the OU 1-07B RI/FS is being completed. Performance information will facilitate the OU 1-07B RI/FS by providing site-specific data to be used to evaluate the potential performance and engineering requirements of final remedial actions.

On the basis of existing information and an analysis of all remedial alternatives, DOE, EPA, and IDHW believe that the selected remedy will achieve these objectives. The interim action will end if it is determined that it is no longer effective or when the ROD for OU 1-07B is signed. The OU 1-07B ROD will address future use of the components of the interim action remedy.

9.1 Major Components of the Selected Remedy

The major components of the selected remedy include:

- Extract contaminated groundwater from the TSF-05 injection well and perhaps nearby groundwater monitoring wells that are capable of capturing contaminated groundwater.
- Install two groundwater monitoring wells within the contaminant plume to monitor the effectiveness of the interim action. These wells may also be used as extraction wells to expedite the removal of contaminated groundwater.
- Install on-site groundwater treatment facilities to reduce contaminants of concern in the extracted groundwater to prescribed performance standards. The selected treatment system is air stripping, carbon adsorption, and ion exchange.
- Monitor the groundwater contaminant plume and the extraction/treatment system during groundwater extraction activities to track the effectiveness of the system and to ensure that performance standards are achieved.
- Modify the existing TAN disposal pond to receive the treated groundwater and ensure that discharge water quality does not further degrade the underlying Snake River Plain Aquifer above maximum contaminant levels.
- Implement administrative and institutional controls that supplement engineering controls and minimize exposure to releases of hazardous substances during remediation.

During operation of the interim action, the system's performance will be monitored on a regular basis and modified as warranted by the performance data. Modification may include any or all of the following:

- Alternate pumping of wells to eliminate stagnation points.
- Pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to dissolve into the groundwater.
- Discontinue pumping at individual wells where remediation objectives have been attained.

It may also become apparent during design, implementation, or operation of the effluent discharge system that the TAN disposal pond is not an appropriate discharge point. In such a case, the interim action will cease operation until other alternatives for effluent discharge can be considered.

The residual spent carbon will be transported off-site for regeneration at a facility operating in compliance with EPA's Revised Procedures for Planning and Implementing Off-Site Response Actions. Other waste residuals from the treatment process will be addressed on-site at existing facilities as described in Section 9.2.5 and Table 9-1.

9.2 Remedial Action Objectives

The OU 1-07B RI/FS report will evaluate the effectiveness of the interim action in meeting the objectives. This evaluation will be incorporated into the ROD for the OU 1-07B RI/FS.

9.2.1 Pumping Rates

An average pumping rate of approximately 50 gpm is expected with occasional pumping rates of 10 to 100 gpm. Actual pumping rates will be determined to ensure efficient contaminant removal based on engineering and hydrogeologic considerations.

9.2.2 Treated Effluent

Alternative 2 will achieve the interim performance standards listed in Table 9-2 for the contaminants of concern in the treated effluent. These standards are protective to levels appropriate to the use of the Snake River Plain Aquifer as a drinking water source, and are technically practicable from an engineering perspective.

The effluent discharge standards for TCE, PCE, and lead are based on not creating a condition that would cause MCLs to be exceeded in the aquifer as a result of treated water discharge to the disposal pond. These standards are relevant and appropriate as in situ groundwater performance standards.

The standards for protection against radiation (10 Code of Federal Regulations [CFR] 20) specify limits for radionuclides in effluents that may be released to unrestricted areas. Environmental fate and transport modelling demonstrates that effluent concentrations of strontium-90 will not exceed the MCL when that effluent reaches the aquifer. The modelling considered 2 years of effluent discharge (the anticipated duration of the interim action), contaminant transport through the unsaturated zones, and radionuclide half-lives.

9.2.3 Air Emissions

Interim performance standards listed in Table 9-2 are technically practicable from an engineering perspective and are protective to levels appropriate for controlling emissions into the air.

Table 9-1. Waste treatment, storage, and disposal options for investigation-derived, laboratory, and treatment process wastes.[a]

Waste	Media	Generated from	Potential Hazardous or Radioactive Contaminants[b]	Treatment	Storage[a]	Disposal
Investigation-derived						
Well purge or development water	Water	Sampling or well development, or decontamination	TCE, Sr-90, tritium	Interim action facility or TAN PWTU	Not Applicable	TAN disposal pond
Drill cuttings[d]	Soil	Well drilling	TCE, Sr-90, tritium, cesium-137	Field survey organics and rad. If rad or hazardous, grouting or incineration	at TAN storage facility or near the TAN well head	RWMC - radioactive TAN - nonrad/ non-haz
Sediment or sludge from TSF-05 injection well	Solid	Process Equipment, Sampling	TCE, Sr-90, tritium, cesium-137, cobalt-60	Incineration or grouting	at TAN storage facility	RWMC after treatment
PPE, solid wastes, contaminated sampling and process equipment	Solid	Facility operation and maintenance	Sr-90, cesium-137, cobalt-60	Decon material, field rad survey, send to disposal facility	at TAN storage facility	RWMC - radioactive Central landfill or off-site facility if nonrad/ non-haz
Laboratory wastes						
TCLP/CLP Semi-volatile analysis wastes[c,e]	Liquid, Soil, Solid	Sampling	Sr-90, tritium, methylene chloride	Recycling or incineration	at TAN storage facility	Off-site (non-rad) or on-site facility (rad)
TCLP/CLP metal analysis wastes[c]	Liquid, Soil, Solid	Sampling	lead, Sr-90, tritium, nitric acid	Neutralization. Then interim action facility or TAN PWTU (liquids). Grouting, if needed, then disposal (solids)	at TAN storage facility	TAN disposal pond - (liquids) RWMC - rad solids TAN - nonrad/non-haz solids
TCLP/CLP volatile analysis wastes	Liquid, Soil, Solid	Sampling	TCE, PCE, Sr-90, tritium	Interim action facility or TAN PWTU (liquids). Incineration, if needed, then disposal (solids)	at TAN storage facility	TAN disposal pond - (liquids) RWMC - rad solids TAN - nonrad/non-haz solids
Alpha/beta and inorganics analysis wastes	Liquid, Soil, Solid	Sampling	Sr-90, tritium, acids	Neutralization. Then interim action facility or TAN PWTU (liquids). Grouting, if needed, then disposal (solids)	at TAN storage facility	TAN disposal pond - (liquids) RWMC - rad solids TAN - nonrad/non-haz solids

Table 9-1. (continued).

Waste	Media	Generated from	Potential Hazardous or Radioactive Contaminants[b]	Treatment	Storage[a]	
Treatment residuals						
Spent activated carbon	Solid	Process Equipment	TCE	Incineration and recycling	at TAN storage facility	Off-site facility
Sediments	Solid	Process Equipment	cesium-137, cobalt-60	Incineration or grouting	at TAN storage facility	RWMC
Spent ion exchange resin	Solid	Process Equipment	Sr-90, cesium-137, cobalt-60	None	at TAN storage facility	RWMC

a. Treatment, storage, and disposal options given are the preferred choice. If these facilities or options are not available, equivalent facilities or options will be used, or the wastes will be stored at the TAN storage facility until treatment or disposal options are available, or until a final remedy under an applicable ROD is implemented. This storage area will meet RCRA substantive requirements.

b. The contaminants listed are those that could potentially be found in the waste at levels above RCRA characteristic limits for hazardous contaminants or above detection limits for radioactive contaminants. These contaminants may not be found in the wastes. If these contaminants are not found, the identified treatment, storage, or disposal option would not be implemented.

c. These laboratory analysis methods use chemicals to improve the efficiency of the analysis process (i.e. methylene chloride is added for semi-volatile analyses; and acids for metals, alpha/beta, and inorganics). If radioactive contamination is detected in the analysis waste, these chemicals would be returned to the INEL. These laboratory wastes may be generated to determine appropriate disposal of the process and investigation-derived wastes. These laboratory wastes would be small in volume (less than 100 mL per sample), thus the waste would be stored similar to Note (a) until sufficient volume is available for the identified treatment option.

d. These cuttings would be surveyed with field instruments for hazardous and radiological contamination. If the cuttings do not exceed screening action levels (less than 25 parts per million organics based on headspace analysis, less than 100 counts per minute of beta/gamma, or no detectable alpha), they will be disposed of next to the TAN disposal pond. If the cuttings exceed action levels, they will be stored at the TAN storage facility or a radioactive storage area, pending ultimate disposal based on their waste characteristics.

e. Semi-volatiles are not contaminants of concern, but laboratory analyses could be used for screening purposes.

The emission standard for lead will not exceed 1.5 micrograms per cubic meter, as prescribed by 40 CFR 50.12 (National primary and secondary ambient air quality standards for lead). The emission standard for strontium-90 will not exceed an effective dose equivalent of 10 millirem per year (mrem/yr), as prescribed by 40 CFR 61.92 (National emission standards for emissions of radionuclides other than radon from Department of Energy facilities).

Emission standards for trichloroethylene and tetrachloroethylene were derived using the Idaho Air Quality Bureau's New Source Policy for Toxic Air Pollutants in accordance with Idaho Administration Procedures Act (IDAPA) §16.01.01952,02. Although not legally enforceable, these guidelines will be addressed in implementing the interim action.

9.2.4 Obtain Data on Aquifer Performance

To the extent practicable, data collected under the remedial alternative on contaminant removal effectiveness from the aquifer (sustained contaminant levels), on aquifer characteristics (transmissivity and well response), and on

Table 9-2. Interim performance standards.

Contaminants of Concern	Treated Water Discharge Standards[a]	Air Emission Standards
Trichloroethylene	5 μg/L	0.00051 lb/hr[b]
Tetrachloroethylene	5 μg/L	0.013 lb/hr[b]
Lead	50 μg/L	1.5 $\mu g/m^3$ [c]
Strontium-90	300 pCi/L	10 mrem/yr[d]

a. See discussion in Section 9.2.2 for basis.

b. Emission standards for trichloroethylene and tetrachloroethylene were derived using the Idaho Air Quality Bureau's New Source Policy for Toxic Air Pollutants in accordance with IDAPA 16.01.01952,02.

c. Ambient air concentrations for the lead were taken from 40 CFR Part 50.12, *Primary and Secondary Ambient Air Standards for Lead.*

d. Emission standards for strontium-90 are a National Emission Standard for Hazardous Air Pollutants standard for the effective dose equivalent to the public under 40 CFR Part 61.92, *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities.*

contaminant levels in the groundwater (types and concentrations of contaminants) will also be used in the OU 1-07B RI/FS. These data will be used in the evaluation of the alternatives considered for the final action under the OU 1-07B RI/FS.

9.2.5 RCRA Waste Characteristic Determination

On the basis of an evaluation of existing documentation, DOE has determined that the groundwater contaminants are not listed RCRA hazardous wastes. As appropriate, investigation-derived wastes and treatment residuals will be sampled and analyzed in accordance with §IDAPA 16.01.05005. If these wastes exhibit RCRA characteristics, the wastes would be handled in accordance with RCRA requirements. Treatment, storage, and disposal options for all identified interim action wastes are given in Table 9-1.

The residual spent carbon, which would not be radioactive, will be transported off-site for regeneration at a facility operating in compliance with EPA's Revised Procedures for Planning and Implementing Off-Site Response Actions. The spent resins are not expected to accumulate high concentrations of metals since the levels of the metals in the water are relatively low (Table 5-1). Therefore, the waste resin would not be a mixed waste, but would only be a low-level radioactive waste. Drill cuttings from wells installed near the TSF-05 injection well have not been hazardous in the past, and the cuttings from the interim action wells are also expected to be nonhazardous. Other waste residuals from the treatment process will be addressed on-site at existing facilities (Table 9-1).

9.2.6 Estimated Waste Generation and Disposal Options

The wastes will be disposed in accordance with Table 9-1. Low-level radioactive wastes (an estimated 160 drums of ion exchange resins and sediments) will be disposed of on the INEL at the RWMC in the Subsurface Disposal Area. An estimated 45 drums of hazardous carbon will be regenerated. Minimal quantities (which cannot be estimated at this time) of other hazardous wastes, such as the laboratory wastes identified in Table 9-1, may be disposed of offsite in accordance with EPA's Revised Procedures for Planning and Implementing Off-Site Response Actions. Solid waste (an estimated 275 cubic yards of personnel protective gear and facility paper waste) will be disposed at both offsite and on-site facilities, depending on availability.

If these existing treatment, storage, and disposal facilities are inadequate or unavailable, either:

- The wastes would be stored in a TAN storage area until additional disposal facilities are available, or
- The interim action would be stopped until additional waste storage capacity is available.

The selected remedy is not expected to generate mixed wastes. However, minimal amounts of contaminated sludge that may exhibit mixed waste characteristics could be extracted from the TSF-05 injection well. This material will be dealt with as described in Table 9-1.

10. STATUTORY DETERMINATION

The selected remedy meets the statutory requirements of Section 121 of CERCLA, as amended by SARA, and to the extent practicable, the NCP. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 Protection of Human Health

The selected remedy protects human health by reducing contaminants near the TSF-05 injection well and in the surrounding groundwater. Removing contaminants will also help prevent further degradation of groundwater while the OU 1-07B RI/FS is being completed. Contaminants of concern in the waters discharged to the TAN disposal pond will be treated to achieve the performance standards given in Table 9-2. Any short-term threats associated with the selected remedy could be addressed by engineering controls and standard health and safety practices. In addition, no cross-media impacts are expected.

10.2 Protection of the Environment

Although a quantitative ecological assessment was not completed, a qualitative appraisal of the contaminants of concern suggests that these contaminants will not result in short-term adverse impacts to the aquatic and terrestrial biota at TAN.

The maximum measured concentration of trichloroethylene (1,300 µg/L) in groundwater monitoring wells at the TAN does not exceed the acute (45,000 µg/L) or chronic (21,900 µg/L) freshwater quality criteria concentrations for trichloroethylene. Similarly, the maximum measured concentration of tetrachloroethylene (71 µg/L) does not exceed the acute (5,280 µg/L) or chronic (840 µg/L) freshwater quality criteria concentrations for tetrachloroethylene.

Although the maximum measured concentration of lead (515 µg/L) in groundwater monitoring wells at the TAN exceeds both the acute (83 µg/L) and chronic (3.2 µg/L) freshwater quality criteria concentrations for lead, treatment of the groundwater to the prescribed performance standards should minimize potential ecological effects from the treated effluent. For example, the number of liters of treated effluent that a deer or a duck would have to ingest on a daily basis in order to pose an unacceptable risk was derived from toxicity data. The magnitude of ingestion for a deer was calculated to be approximately 2,040 liters/day and for a duck approximately 160 liters/day. These magnitudes are not possible.

Similar toxicity data for wildlife are not readily available for strontium-90. Because some wildlife might be affected by chronic exposure to strontium-90, the discharge area will be observed on a regular basis for potential impacts to the environment.

10.3 Compliance with ARARs

The selected remedy will comply with all Federal ARARs, and promulgated State ARARs that are more stringent than Federal ARARs.

10.3.1 Chemical-Specific ARARs

- National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities (40 CFR 61.92). This applicable requirement specifies 10 mrem/yr for radiation exposures for the general public from ambient air concentrations of radionuclides.
- National Ambient Air Quality Standards (40 CFR 50.12). This applicable requirement specifies 1.5 μg/m^3 for ambient air concentrations of lead.
- Safe Drinking Water Act (40 CFR 141). This relevant and appropriate requirement establishes MCLs for TCE, PCE, lead, and strontium-90 in groundwater that may be used for drinking water.

10.3.2 Action-Specific ARARs

- Harzardous Waste Management Act IDAPA 16.01.05005, 01.05009, 01.05011. Where RCRA 40 CFR 268 is more strigent than IDAPA 16.01.05011 the federal law will be applicable.
- Applicable requirements of the Regulation of Standards of Performance for New Stationary Sources (IDAPA §16.01.01952, 02) which specifies that new sources of air emissions shall achieve the greatest degree of emission reduction that has been adequately demonstrated.
- Applicable requirements of the rules for the Control of Fugitive Dust, IDAPA §16.01.01251 and -01252 which specify that all reasonable precautions be taken to prevent the generation of fugitive dusts.
- Any applicable substantive requirements of the State of Idaho Wastewater Land Application regulations (IDAPA 16.01.17600) and Water Quality and Wastewater Treatment regulations (IDAPA 16.01.2600). These requirements establish standards for discharges of suspended solids.

10.3.3 Location-Specific ARARs

There are no location-specific ARARs identified for this interim action.

10.3.4 Other Criteria, Advisories, or Guidance To-Be-Considered

IDHW guidelines on emission standards for TCE and PCE (Idaho Department of Environmental Quality Air Toxics Program) will be used as to-be-considered guidelines in facility design. These standards were derived as part of the Idaho Air Quality Bureau's New Source Policy for Toxic Air Pollutants, and are considered consistent with IDAPA §16.01.01952, 02.

To-be-considered, chemical-specific material is contained in DOE order Radiation Protection of the Public and Environment (5400.5), Radiation Protection of Occupational Workers (5480.11), and Radioactive Waste Management (5820.2A) which contain concentration limits on radiation exposures to workers and the public and on releases of material containing radioactive substances. The to-be-considered, action-specific material is contained in DOE orders 5400.5, Environment, Safety and Health Program for DOE Operations (5480.1B), Hazardous and Radioactive Mixed Hazardous Waste Management (5480.3), Environmental Protection, Safety and Health Protection

Standards (5480.4), 5480.11, and 5820.2A. These orders contain requirements for monitoring waste storage facilities, packaging and shipping wastes, and on implementing environmental regulations at DOE facilities.

10.4 Cost Effectiveness

The selected remedy is cost-effective and provides overall effectiveness proportional to its costs and duration for protection of human health and the environment.

10.5 Use of Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Possible

DOE, EPA, and IDHW have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for this interim action. Of those alternatives that are protective of human health and the environment and comply with ARARs, DOE, EPA, and IDHW have determined that this selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

The selected remedy for OU 1-07A is intended to help prevent further degradation of the groundwater by reducing contaminants near the TSF-05 injection well and in the surrounding groundwater. Although this interim action is not the final action, it will not be inconsistent with nor preclude the final response action scheduled to be selected in 1994.

10.6 Preference for Treatment as a Principal Element

By treating the contaminated groundwater using a combination of air stripping, carbon adsorption, and ion exchange, the selected remedy partially satisfies the statutory preference in which treatment, as a principal element, permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances. The preference will be fully addressed by the final response action.

11. EXPLANATION OF SIGNIFICANT CHANGES

The DOE, EPA, and IDHW have reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy, as it was originally identified in the Proposed Plan, were necessary.

However, as a result of further review of the Proposed Plan incidental to the public review period, the following clarifications need to be made to the Proposed Plan.

(1) The 90% reduction in treated effluent contaminant levels proposed for the interim action treatment facility have been changed to the interim performance standards as described in Section 9.2.2 and given in Table 9-2. The new performance standards are technically practicable, and are expected to be protective of human health and the environment.

(2) The Proposed Plan stated that strontium-90 levels of up to 230 pCi/L were found in the groundwater samples collected during late 1989 and 1990. After further review of the 1989 and 1990 groundwater data during preparation of the RI/FS work plan, an analytical result of 680 pCi/L of strontium-90 was found for well TSF-05. This increase in strontium-90 levels will not cause a change to the Proposed Plan or the final remedy

because strontium-90 was already listed as a contaminant of concern and was already listed as being above MCLs. This increase will cause a change in the design of the treatment facility by increasing the requirements for the ion exchange system.

(3) The Proposed Plan stated that only TCE was found above MCLs further than 1/4 mile from the TSF-05 injection well. Further review of the 1990 groundwater data also showed a well 1 mile from the TSF-05 injection well that had PCE concentrations of 8 to 9 µg/L just above the MCL of 5 µg/L. This change in the size of the PCE plume will not cause a change to the Proposed Plan or the final remedy because PCE was already listed as a contaminant of concern. This change also fits within the original concept of using other wells in the contaminant plume farther from the TSF-05 injection well to decrease contaminant levels.

(4) Interviews conducted with TAN personnel have indicated that concentrated sludges were disposed of in the TSF-05 injection well in addition to the liquid wastes mentioned in the Proposed Plan. These sludges would have come from an evaporator that processed the same types of liquid wastes that were discharged to the well. Also, the condensate from the evaporator was discharged to the well. This sludge was removed in January 1990 as described in the Proposed Plan. The sludge has been analyzed and the data were placed into the Administrative Record for the interim action on or about January 3, 1992. The types of contaminants found in the groundwater are similar to the types found in the sludge, thus information on sludge being disposed of in the TSF-05 injection well will not affect the final decision under the Proposed Plan.